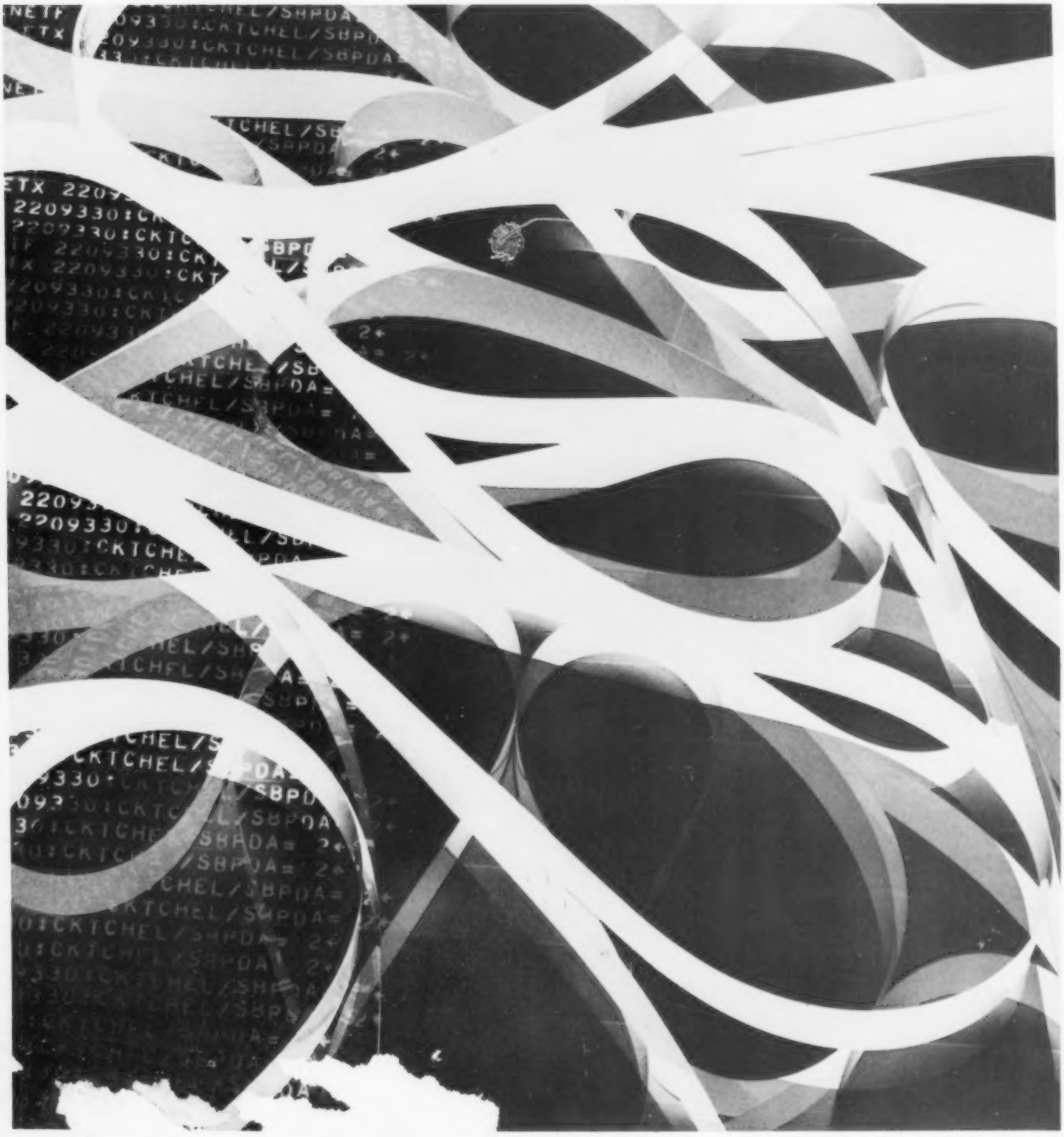
DIMENSIONS

The magazine of the National Bureau of Standards U.S. Department of Commerce

March 1978



COPYRIGHT AND THE COMPUTER. See page 8.

COMMENT

THE NBS BUDGET IN FY 1979

The National Bureau of Standards' budget proposed to Congress for fiscal year 1979 is an increase of $24.2 million dollars over fiscal year 1978. In my view, this increase represents an encouraging start toward providing NBS with the resources necessary to perform its mission.

The fiscal year 1979 increase, if approved by Congress, would be a 34 percent increase over fiscal year 1978. This major increase is due to a number of factors.

- NBS analyzed and documented how thinly resources were spread in comparison to assigned responsibilities.
- The NBS Visiting Committee strongly and actively supported the NBS need for additional resources.
- Assistant Secretary Baruch aggressively made our case in the Department of Commerce and in other policy-making forums within the Administration.
- The Administration has taken a positive stance regarding support for science and technology. President Carter said, when presenting the National Medal of Science Awards in November, that in many instances agencies have relegated R&D to a fairly low position of priority. In response, he has ordered OMB "to boost those research and development items much higher, and they will be funded accordingly."

A breakdown of the fiscal year 1979 budget as proposed to Congress is shown on page 23 of this magazine. Two items in this budget that have a pervasive effect on NBS are adjustments to base and equipment modernization. An increase of approximately $5.2 million is proposed to offset rises in the cost of living. The budget also includes about $2.5 million for equipment modernization. These items contribute to the effective operation of all NBS programs.

In my opinion, the item of greatest significance to the National Bureau of Standards is the $2 million increase for competence building. The money itself would provide us with an opportunity to make a start on building our competence to meet the demands that will be placed on NBS in the future. Moreover, the approval of such an increase by the Administration is a significant recognition of the need for increased research effort at the Bureau. Over the next several months, we will be cooperating on a study of NBS with the Executive Office of the President. I am optimistic that this study will confirm the need for expanded technical research efforts at NBS. Such a conclusion would provide a basis for additional resources for competence building in future years.

The largest single increase proposed for fiscal year 1979 is $13.4 million to expand our efforts to improve the efficiency and effectiveness of federal use of computers. This program is mandated by the Brooks Act. It is our expectation that by 1984 the NBS efforts made possible by this increase will have saved the federal government over $400 million annually.

The National Bureau of Standards is proposing $2 million in fiscal year 1979 to begin a new effort called cooperative technology. In fiscal year 1979, NBS will conduct an investigation to test the desirability of a cooperative program with U.S. industry to foster the development and dissemination of underlying technologies that would enhance industrial productivity and competitiveness. If the results of the investigation warrant, an operational program will be established.

The other proposed NBS program expansions are:

Nondestructive Evaluation—An increase of $.9 million is proposed to provide NDE standards and measurement methods to assess the quality of materials, finished products and operating assemblies. The potential savings through the use of NDE are large. For instance, with currently available NDE technology, the John Hancock Building in Chicago was constructed with about half the steel that would have otherwise been required.

NBS Reactor—A proposed increase of $.6 million will be used to double the power of the reactor, thereby increasing the number of experiments possible each year, reducing waiting time, and improving the scientific versatility of the reactor.

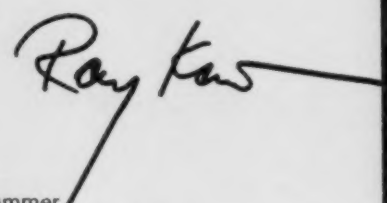
Automation Technology—An increase of $.8 million is proposed to provide dynamic measurement techniques, standards, and guidelines to encourage the application of automation technology in government and industry. Computer-based automation systems can increase productivity by over 300 percent in batch manufacturing operations.

Central Planning—A proposed increase of $.9 million will help NBS in identifying and analyzing the needs of scientific, governmental, and industrial users of NBS services.

Recycled Oil—An increase of $1.6 million has been proposed for this effort as a fiscal year 1978 supplemental. The objective is to develop test procedures to establish the substantial equivalency of re-refined used oil with virgin oil for various applications. This effort will contribute to pollution abatement and energy conservation.

A program reduction of $1.9 million is contained in the fiscal year 1979 budget for the air and water pollution measurement programs. There are indications that the Environmental Pollution Agency will fund the National Bureau of Standards' efforts in this area in fiscal year 1979, but the specific projects to be supported are not yet clear.

On balance, the National Bureau of Standards budget for fiscal year 1979 is an encouraging one. Moreover, the environment for research and development institutions in the federal government appears to be improving.



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UPDATE

A Problem of Growing Concern: **EMI**

by Frederick P. McGehan

THIS is a sign commonly seen along highways where repair or construction is underway. It is perhaps the public's clearest indication that there is a problem called electromagnetic interference (EMI for short).

Most people are not familiar with the term EMI. However, many do know what can happen if a driver operates a mobile radio while passing through an area where there is blasting: The radio can generate a signal that triggers blasting caps on dynamite. The result can be disastrous. Hence the sign.

This is just one very small example of EMI, a problem that has been growing rapidly in the last two decades to the point that the skies over our large cities have become literally choked with electromagnetic radiation. The sources are legion: radar installations at airports, radio and television broadcasting towers, CB and mobile radios, and even sensors buried in our roadways that tell the traffic lights when to change.

The terms "electromagnetic smog" and "electromagnetic pollution" have been coined to describe the consequences of all this radiated energy. Its proliferation in our environment results in interference with all types of electronic equipment, from mammoth computers to TV sets and heart pacemakers. Where the electronic devices are used to control a vital function—such as regulation of the heartbeat—EMI can be dangerous.

The military is concerned because it uses electronic control systems in very sophisticated ways for fast, reliable control to replace or complement the trained GI. Very sophisticated display systems are often heavily supported by electronic control equipment. And among its many concerns, the military recognizes that a stray electromagnetic signal might accidentally damage or even detonate munitions.

In addition to the interference problems, there is increasing concern on the parts of the medical and scientific communities over the biological effects of this radiation on humans and animals. Initially it was believed that electromagnetic radiation produced only a heating effect in living tissue. Lately there has been evidence to suggest that there may be long-term, subtle consequences possibly involving the nervous system.

EMI problems have aroused interest in several federal agencies, including the Environmental Protection Agency, the Department of Transportation, the White House Office of Telecommunications, The Federal Communications Commission, and the Department of Defense. Many of the organizations have come to the National Bureau of Standards through its Electromagnetics Division in Boulder, Colorado, for assistance. They have come for help in determining the EMI environment and the susceptibility of individual pieces of electronic equipment to interference, and for help in finding ways to evaluate effective protection of equipment intended to prevent interference.

The electromagnetic story goes back to 1873 when James C. Maxwell, director of the Cavendish Laboratory, Cambridge University, postulated the existence of electromagnetic radiation. This theory was confirmed in 1888 by German physicist Heinrich Hertz who produced the first man-made electromagnetic wave. Succeeding inventors, most notably Guglielmo Marconi, devised equipment to generate and receive electromagnetic waves, particularly in the radio range of the spectrum. As a result, the world witnessed first wireless telegraphy and then voice transmission, which came to be known as radio.

Although entire industries were spawned by these discoveries, the amount of man-made electromagnetic radiation in the environment was relatively small until World War II. Most of the radiation resulted from radio broadcasting.

The discovery of microwaves in the 1930's, and their application to radar during the war, led to new sources of electromagnetic radiation. After the war, radar was adapted for civilian uses and microwaves were used, among other ways, for long distance telephone communication.

The development of semi-conductors, which allow more electronics to be placed in smaller and smaller configurations, added new sources of and targets for electromagnetic interference. The electronics revolution has now progressed to solid-state integrated circuitry and microprocessors that have resulted in low-priced CB radios and land-mobile transceivers and in applying control systems to difficult problems.

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McGehan is a public information specialist with the NBS Program Information Office in Boulder, CO.

The consequence has been a dramatic increase in electromagnetic irradiation. At the end of World War II there were only six television stations in the country; today there are more than 1000 stations that transmit to 120 million television sets. In the same period, the number of radio broadcasting stations jumped from 930 to 8000. And a whole new era of broadcasting was ushered in with the popularization of CB radios. There are some 15 million licensed CB radios in homes and vehicles across the nation. In 1975 the Federal Communications Commission received more than 100 000 complaints concerning radio interference—and the FCC estimates fewer than one in ten interference problems gets reported. The Commission figures 9 million people will experience TV interference from CB radios in the year ending June 30, 1979.

The EMI problem promises to continue to grow, particularly in the automotive industry, as mechanical parts and devices are replaced with electronic components. A foretaste of this came in 1975 when a National Highway Traffic Safety Administration regulation required the use of anti-skid braking systems on all new trucks and buses. To comply with the stringent NHTSA regulation, the industry chose systems that are electronically controlled. Unfortunately it was found that in some cases the operation of a CB radio in the truck or bus or in an adjacent vehicle was enough to trigger the braking mechanism. Because of this and other problems, the regulation was suspended for more than a year while bugs in the new braking systems were worked out. Some 18 000 new trucks were recalled in 1975 because of the EMI problem.

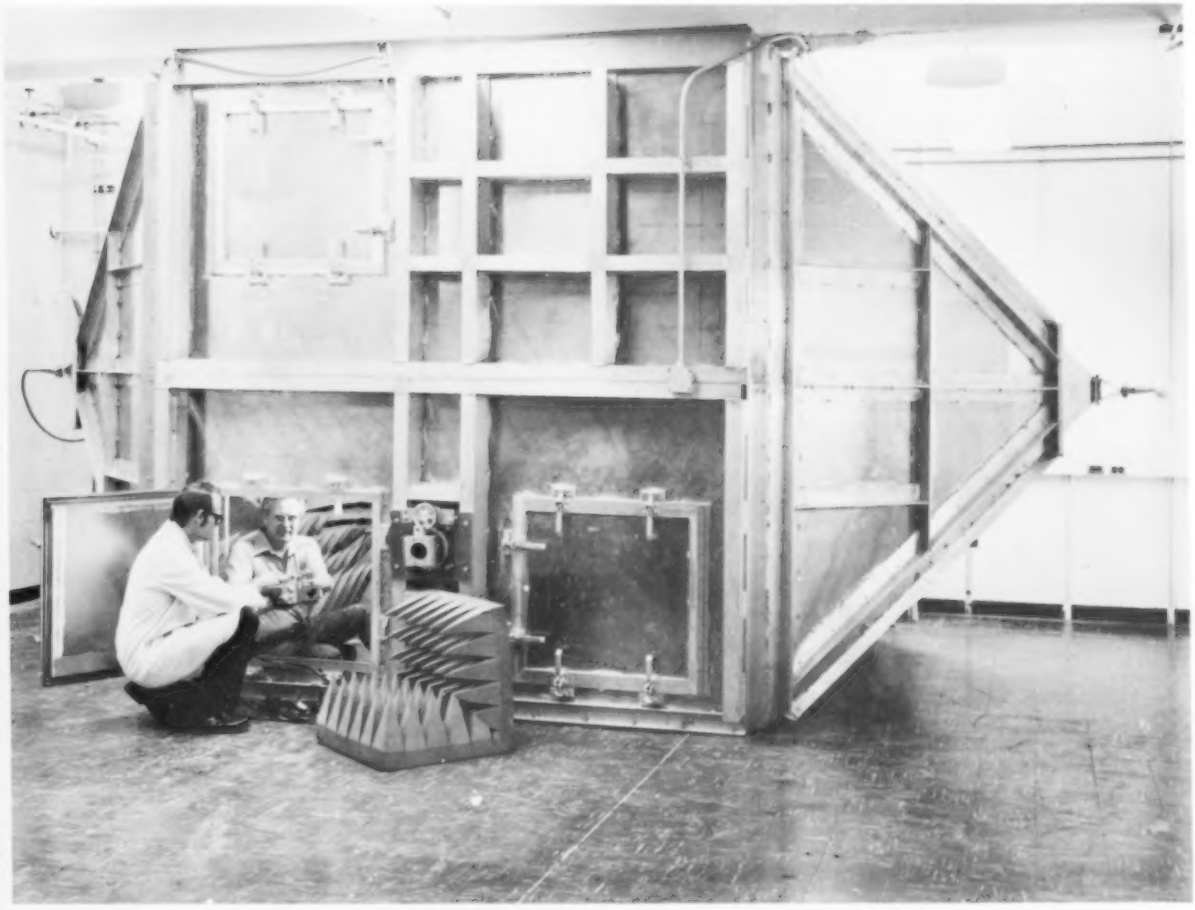
Detroit has already begun introducing electronic controls—microprocessors—on selected lines of automobiles and wants to begin using them extensively within the next few years. These microprocessor-based systems will be programmed to minimize exhaust pollutants, manage fuel consumption, advance the spark, monitor safety functions, and optimize transmission shifting. In addition, air bags, which may become a mandatory safety device in future years, are triggered by electronic controls. Auto makers are fearful that their heavy investments in these new systems could be compromised by EMI. At an NBS-sponsored conference on EMI at Gaithersburg, Maryland, last July, automotive engineers called for more government-sponsored research on EMI and the electromagnetic environment in which vehicles operate in order to avoid overdesigning their new electronic control systems and to assure their safety for public use.

Another recommendation made at that conference was for the increased development of modern measurement methods to compare the performance of individual small electronic components to that of large integrated systems in the face of mounting EMI problems. Interestingly, NBS is developing methods to measure both the impact of components on the electromagnetic environment and of the environment on the components. And the task is not easy.

Part of the difficulty lies in the nature of electromagnetic waves and the way they propagate (transfer energy). At a distance comparatively far from the radiating source, the waves are relatively easy to measure and techniques for doing so have been known for a long time. The wave's shape is well defined at such a distance, and, if you were standing in front of it and could see it, it would resemble a plane of material moving towards you. Measurement under these circumstances usually requires instrumentation and good practice that recognize and identify reflections from the ground and other objects that can obscure the primary signal.

However, most important in terms of EMI and the biological consequences of electromagnetic irradiation is the so-called near field. This can be comparatively close to the radiating object, say from a few centimeters or meters for a CB radio or land-mobile radio up to two kilometers for a satellite tracking station. It is here that the waves have not yet formed into a pattern and measurement is exceedingly difficult. "You can't take the same kind of instruments used for measuring the far field and put them in the near field and expect to achieve meaningful results," says Charles K. S. Miller, manager of NBS' EMI measurement program.

A second difficulty in approaching the EMI problem is the sheer number of interfering signals. If the interference were caused by a single signal, "it would be easy to tackle," Miller notes. By pinpointing the frequency and amplitude of the incoming signal, it would be possible to develop a shield and provide filtering on incoming wires to protect the electronic component from EMI at any one frequency. But that is not the case in nature or in the world as man makes it. "In the living environment you have a phenomenal number of different signals," Miller says. They come from radio and TV broadcasting stations; mobile radios in police cars, trucks and cabs; marine band radios; CB radios; and even satellites. Other devices include radar sets, garage-door openers, burglar alarms, active traffic



Electronics engineer Myron L. Crawford (left) hands a piece of electronic equipment to technician John L. Workman who is inside the Bureau's Transverse Electromagnetic Cell. The piece of equipment will be tested for susceptibility to electromagnetic interference.

sensors, arc welding machines, electric motors, auto ignition systems, and the corona of high-voltage power lines.

Miller sees the environment becoming messier as new, consumer-oriented products come onto the market that radiate weak electromagnetic signals. He cites as examples the types of antiburglar devices for use in businesses and homes, that employ microwaves or radio waves and the new TV and electronic games. He also believes the frequency components and waveform characters of new communications systems might add complications that are not presently anticipated.

Still another difficulty in guarding sensitive electronic components against EMI is the fact that some of the equipment, particularly when used in motor vehicles, is constantly moving in and out of different electromagnetic environments. In addition to worrying about EMI from broadcasting and radar stations, designers of electronic components for vehicles must take into account such things as electromagnetic sensors buried in the roadway to trigger traffic lights. A stray signal could cause a braking system to malfunction at an intersection and place the lives of the driver and others in danger. And, in addition to planning for all current electromagnetic environments, the designer has to try to anticipate future uses for electromagnetic waves and the corresponding potential for detrimental changes to the environment.

Two federal agencies in particular, the Environmental Protective Agency and the Department of Transportation, are interested in measuring the sources and amount of electromagnetic radiation in the environment. In its efforts to protect the public from non-ionizing radiation, EPA is interested

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Dean G. Melquist, an electronics technician with NBS/Boulder laboratories checks the electromagnetic radiation pattern of a waveguide horn in a newly constructed anechoic chamber.

in developing a data base on electromagnetic radiation for major U.S. cities. With such a base, the agency could determine over a period of years whether the electromagnetic environment is deteriorating, and if so, by how much. The Department of Transportation is interested in measuring the EM environment around vehicles to define typical serious conditions to which automobiles will be exposed.

In its work for DoT, the NBS Electromagnetics Division performed on-site measurement studies utilizing specially designed instrumentation near vehicles that were equipped with mobile radios. The NBS measurements showed, to the surprise of the auto industry, that the near-field electromagnetic environment frequently was higher than the currently accepted U.S. Standard for EM radiation exposure. Miller believes that the seriousness of this problem will increase as manufacturers encase electronic components in plastic rather than in metal and as metal shells are replaced by plastic ones in new vehicles. Current plastics offer no shielding against EMI. High EM field levels around vehicles, Miller believes, not only endanger the functioning of electronic components but also pose potential health dangers to vehicle occupants. Ironically, he notes, some of this irradiation comes from the very CB and mobile radios the drivers use.

Working for the Federal Aviation Administration (FAA), NBS has been developing EM measurement instrumentation, methodology, and data so the FAA can determine radiation levels around antenna sites and airports and in airplanes. The FAA is interested in avoiding or minimizing EMI problems that would disrupt navigational equipment, electronic displays for instrumented landings, electronic controls on the ground and in aircraft, and telecommunications. The FAA is also concerned for the health and safety of people who use equipment that produces high electromagnetic fields. As in many other areas of

The probe shown here is being used to measure the radio frequency energy level around a CB antenna mounted on a vehicle.

EMI measurement, the expertise and equipment to make the complex measurements do not exist in private industry and can be found only at NBS.

Indeed, over the past several years the Bureau has pioneered the development of novel instruments that can measure both the electrical and magnetic fields contained in EM waves. In 1973 a group of scientists in NBS' Electromagnetics Division won an award from *Industrial Research Magazine* for their development of a portable probe, called an electric energy density meter, that can be used to measure EM emitted by such diverse sources as navigational systems, microwave ovens, and radio and TV transmitters.

Another notable NBS contribution has been the development of the transverse electromagnetic (TEM) cell. This, essentially, is a large "clean room" where electronic machines and components can be tested for susceptibility to known sources of EMI or for EM output. In its most recent version, NBS has constructed a TEM cell that measures three meters by three meters by six meters and resembles somewhat a large, square boiler. The cell provides a three-quarter cubic meter test volume. More precise data on a component's vulnerability to EMI can be determined in the TEM cell's controlled environment than in the outdoors where the EM environment is continuously changing and hard to define.

In the decade since NBS first conceived the TEM cell for the EMI measurements, a number of others have been constructed for use by the military as well as by private industry. AC Spark Plug, Motorola, RCA and Zenith are some of the firms that have adapted the TEM cell for their own EMI measurement and testing programs. The performance of the cell is limited by its size, and its size limits what it can test.

NBS is currently constructing an anechoic chamber at the Boulder laboratories. The absorbent material in this large room will prevent EM signals from bouncing or reflecting off walls and disturbing delicate measurements. "It's the difference between trying to take pictures in a room made of mirrors and a room with a soft, low-reflecting background," Miller says.

Because the concern over the question of "electromagnetic smog" is relatively recent, the mechanisms for defining and combating the problem are still being developed. The government needs to coordinate the activities of the nine separate federal agencies that are now involved in some aspects of regulating EMI. Another need is for a common language of EMI. "Right now there are tremendous ambiguities," says Miller, noting that a communications expert and an electronic engineer may have different and therefore confusing ways of defining the same EMI phenomenon. "We need a glossary or dictionary so we can agree on common terminology for measurements and their results," Miller adds.

The urgency of these needs may become apparent over the next few years as more and more electronic control devices are introduced and as medical science uncovers new facts about the effects of long-term, low-level exposure to EM radiation.

One area that is sure to receive attention is the workplace. Some seven million workers are exposed daily to electromagnetic radiation as it is used in various industrial processes such as curing plastic and plywood and operating large arc welding machines. In some industrial measurements taken by the National Institute for Occupational Safety and Health, the EM fields in the working place were at least as high as 2600 volts per meter (where the standard is 194 volts per meter). The fields may have been higher, but the NIOSH instruments, provided by NBS, could not measure above 2600 volts per meter. □

© Copyright and the Computer

by Shirley Radack

INSTRUCTIONS for a computer are written by a human being in special programming language that the computer can process. Should this computer program be considered the writing of an author?

The computer reads the program as electronic impulses from magnetic tapes. Is this writing, which is invisible to the human eye, copyrightable?

These are two of several questions addressed in a recent study by the National Bureau of Standards on the applicability of copyright to computer programs and other computer-readable works.*

Protection for computer readable works is not clear under the present copyright statute, according to Roy Saltman, manager of the NBS project. "We were asked by the National Science Foundation to conduct a multi-disciplinary, policy-oriented study to help clarify some of the issues involving computer readable works," he says. Public policy issues concerning copyright are currently before the National Commission on New Technological Uses of Copyrighted Works (CONTU), which was established to advise Congress on the use of copyrighted materials in conjunction with computers.

"We are recommending that the copyright law be clarified to assure protection for computer programs and other computer-readable works," says Saltman. The NBS research study explores the complex mosaic of legal, economic, and technical issues involved in copyright for computer readable works. The recommendations for change and the underlying analysis of the issues have been published** and reported to CONTU for its use in recommending policy changes to Congress.

Some of the key findings and conclusions of the NBS study on copyright are summarized in this article. The basic principles that support the recommendations for change are on page 11.

Radack is in the Office of the Director, NBS Institute for Computer Sciences and Technology. This article concerns work carried out in that Institute.

* The study is based on research sponsored by the Division of Science Information of the National Science Foundation.

Foundation of Copyright

The concept of copyright has its roots in the English common law and in the writings of the English

** *Copyright in Computer-Readable Works: Policy Impacts of Technological Change*, NBS Spec. Publ. 500-17 by Roy G. Saltman. For sale by Government Printing Office, Washington, D.C. 20402 at $4.00 a copy. Order by stock number 003-003-01843-1.

philosopher John Locke (1632-1704). Locke wrote in his *Second Treatise on Civil Government:*

". . . every man has a property in his own person . . . The labor of his body and the work of his hands we may say are properly his. . . ."

The principle of copyright was incorporated into the U.S. Constitution by its framers. Article I, Section 8, gives Congress the power "to promote the progress of science and the useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries . . ." This Constitutional provision balances the needs of both creators and the public by giving creators exclusive rights to their creations and thereby stimulating the growth of learning and culture to benefit society at large. Copyright protection is based on a *quid pro quo* principle: the copyright owner is protected by law and can benefit from his work, but in return he must disclose his work. Copyright protects only the creator's expression of an idea, not the idea itself. Others are free to express the same idea in their own way.

Since the passage of the first copyright act in 1790, judicial interpretations and changes to the statute have adapted to the needs of a changing society. Revisions and modifications have extended copyright protection to new technologies. Decisions on copyright policy have involved a complex balancing of the interests of the creators of original works, the users, and the public at large.

The first act covered maps, charts and books. Later revisions to the law in the nineteenth century covered engraved prints, sheet music, photographs, and works of fine art.

The fast pace of technological change in the twentieth century stimulated new forms of creative works that have been gradually brought under copyright protection through Congressional actions and court decisions. Coyprights can be obtained for sound recordings, motion pictures and their sound tracks, radio and television transmissions, cable television retransmissions, and microfilm and video tape recordings.

Works that cannot be read by the human eye have been a dilemma for decisionmakers. In the early part of the twentieth century, phonograph records and piano rolls for player pianos were not protected by copyright. These works were not considered to be copies of musical compositions since they were not visually intelligible to humans. In 1971, however, Congress included sound recordings under copyright when record piracy became a serious problem.

The 1976 General Revision to the copyright law provided for copyright of works "fixed in a tangible means of expression." It defines copies as:

". . . material objects . . . in which a work is fixed by any method now known or later developed, and from which the work can be perceived, reproduced, or otherwise communicated, either directly or with the aid of a machine or device."

This provision resolves the question of copyright for works such as microfilm and videotape recordings that cannot be read directly, but can be made readable with the aid of a device. The 1976 law also addressed the copyright issues connected with photocopying of books and journals. It provides for "fair use" of copyrighted materials to try to solve the conflict between authors and publishers on one side and librarians and educators on the other.

Another important principle established by copyright law is that of compulsory license. A general revision to copyright laws in 1909, before phonograph recordings were copyrightable, gave copyright owners of musical compositions the exclusive right to arrange and record their works. However, others could also use the copyrighted works by paying a royalty to the copyright owner. This step prevented anticipated monopoly of musical recordings.

The 1976 law which established copyrightability independent of the medium in which a work is fixed did not make clear the rights of creators of computer programs and other computer readable works. The law states that "the owner of copyright . . . has the exclusive rights . . . (1) to reproduce the copyright work in copies of phonorecords and (2) to prepare derivative works based upon the copyrighted work. . . ." This means that the right of conversion of a copyrighted work from one medium to another is reserved to the proprietor, with certain specific exemptions. If a copyrighted work can be converted to a computer-readable format without actually using a computer to do it, the converted work is probably protected. However, protection for a computer readable work that is used in a computer or converted to computer readable format using a computer is not clear.

"We are recommending that the copyright law be clarified to assure protection for computer programs and other computer-readable works."

COVER STORY

Copyright for Computer Programs

An underlying principle in copyright matters is that the public benefits from transfers of information. Copyright registration allows public access to original works and gives the copyright owner maxi-

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mum legal protection in disputes about infringement.

The importance of scientific and technical information to the U.S. has been noted by many observers such as sociologist Daniel Bell who characterized the U.S. as a post-industrial society "organized around information and utilization of information in complex systems, and the use of that information as a way of guiding the society."

The NBS study notes that computer programs are "more than simply a set of instructions used to operate a machine. Computer programs are involved, in their operational use, in a variety of real human purposes," such as research and professional activities. For example, computer programs that analyze electrocardiogram signals and assist physicians to diagnose heart ailments "constitute models of the heart's operation."

The research study concludes that computer programs are original writings of authors and that they deserve the protection of copyright. The unauthorized copying of computer programs is "a type of market failure," according to Saltman of NBS. "The copier of an error free program has obtained something of considerable value at minimum expense."

Other recommendations concerning copyright for computer programs are:

- Only the source code program should be copyrighted. The source code is the language in which the programmer writes the program. This program is then converted into an object code that is usable directly by the computer and is virtually unreadable by a human. Revealing the object code by registration would reveal very little and would not be consistent with copyright doctrine which exchanges protection of copyright for disclosure. Saltman says, "We suggest that the conversion of a source program into object code constitutes the making of a copy since no additional logic has been added to the program. Therefore we suggest that the object code should be protected by virtue of the copyright in the original source program."
- The conversion of a program to another source language should be considered the making of a derivative work and the translation should be protected under copyright.
- Duration of protection for computer programs should be the same as for other copyrightable works, in order to promote the use of computer languages that can be expected to endure.

Copyrightability of Computer Readable Data Bases

"We also recommend that computer readable data bases, whether compilations, collective works, or reference works of a single author should be copyrightable," says Saltman. A data base is formed by collecting and assembling pre-existing materials or data which are then arranged in such a way that the resulting work as a whole constitutes an original work of authorship.

Computer readable data bases are similar to other compilations such as encyclopedias which are copyrightable. The copyright applies only to the arrangement or organization of the materials, not to the individual materials contained in the compilation.

Since disclosure of information is beneficial, Saltman recommends that "data bases be deposited in the Library of Congress where anyone can examine any computer readable work published with copyright notice." In this way disclosure can contribute to scholarship, historical review and the generation of new ideas. Saltman adds, "whether the disclosure should take place as a printout or a magnetic tape is not clear, but it should be the complete data base. Since data bases are updated frequently, it seems reasonable to suggest that a yearly update be made. A totally new data base could be deposited every ten years."

An unanswered question is what constitutes publication of a data base that has not been previously published in a paper edition. Display of a data base at a terminal for use by the proprietor or licensee of a data base is not considered publication. The copyright law states that "the offering to distribute copies . . . to a group of persons for purposes of further distribution . . . or public display, constitutes publication."

Saltman says that a reasonable understanding is that a computer readable data base is published "if it is offered to the public on a query basis such that any item in the data base is capable of being retrieved and printed out and the printouts become the physical property of the users on the basis of unrestricted disclosure." Another clarification needed is how many persons constitute a "group of persons" to whom a work has to be offered in order to be published. "These questions are best left to the courts or to the Congress," says Saltman.

An Efficient Marketplace for Copyrighted Works

In addition to assessing the legal framework for extending copyright to computer readable works,

BASIC PRINCIPLES

NBS recommendations on copyright are based on the following set of basic principles which were derived from an analysis of fundamental copyright issues:

- Every person has the right to the fruits of his creations, a concept rooted in the common law and enunciated by English philosopher John Locke.
- Ease of copying or plagiarism of intellectual property results in a market failure: the creator is deprived of his or her inherent rights. Statutory copyright protection for the creator corrects the market failure.
- Copyright protection does not guarantee financial remuneration. The economic value of a work is determined in the marketplace where copyright protects the distributors as well as the creators of intellectual works.
- Opportunities for free economic competition should be encouraged, especially opportunities for the entry of new products and new competitors.
- Copyright protection is based on the *quid pro quo* concept of a social contract: In return for protection of law, the copyright holder makes a public disclosure of his work.
- Dissemination of scientific and technical information should be encouraged subject only to resource constraints and to limitations imposed by personal privacy, trade secrecy, and national security.
- Transaction costs are attached to the market for intellectual property even in the absence of copyright. The kind of transaction costs a society is willing to tolerate as well as the size of such costs have to be considered in structuring a market. In general, the size of transaction costs should be minimized.
- Decision making on copyright involves a balance between the needs of the user, the rights of the copyright owner and the interests of the general public.

the NBS study also considered the costs of enforcing the rights of the copyright owners and users, while minimizing these costs for society as a whole. Some recommendations are:

- Legislation should be enacted to make the sale of computer readable works more attractive than lease or rental. Outright sale would reduce the transaction costs involved—the costs of enforcing the payment of royalties. This would be consistent with the handling of other copyrighted works such as books, maps and phonorecords which are sold. The buyer owns the copy or phonorecord and has the right to resell it. The copyright owner retains the rights to make and sell additional copies of his work, to prepare derivative works, and to perform and display the work publicly.
- The owner of a copyrighted computer readable work should have the right to make additional copies for his internal use, but the work should not be available to outsiders through a computer network or some other means of disclosure.
- Copies made for internal use should be destroyed when the copyrighted work is sold.
- Royalty payments through clearinghouses and price differentials between individual and institutional subscribers to periodical works may be useful and efficient.

Recommendations for Further Study

Extending copyright to computer readable works may also cause unanticipated problems and require further study in areas such as:

- the potential for monopoly in the delivery of computer-readable data-base access services, and
- the difficulties in discovering infringements in the copying and unauthorized sale and use of computer-readable works.

"We hope that our study of copyright will be of value to decisionmakers, as well as to policy analysts and researchers," says Saltman. "Our findings, concusions, and recommendations are not the final, definitive view. Other analyses of the legal and historical precedents may reveal different interpretations, conclusions, and recommendations. We welcome additional contributions to the literaure." □

Exploding a Metric Myth

DUAL USAGE

by Jeffrey V. Odom

Have you heard the rumor that the easiest way to learn metric is to encounter it along with the customary system? It is a commonly held belief, and undoubtedly you have already been exposed to this practice, called dual usage. For instance, weather broadcasts often give the temperature in degrees Celsius and degrees Fahrenheit, and many consumer products are labeled with "dual measurements."

Does the belief that dual usage is a valid and efficient way to learn metric bear up under scrutiny? Experience to date, in the United States and in other metricating countries, suggests that the answer is "NO!"

Odom is metric coordinator of the National Bureau of Standards.

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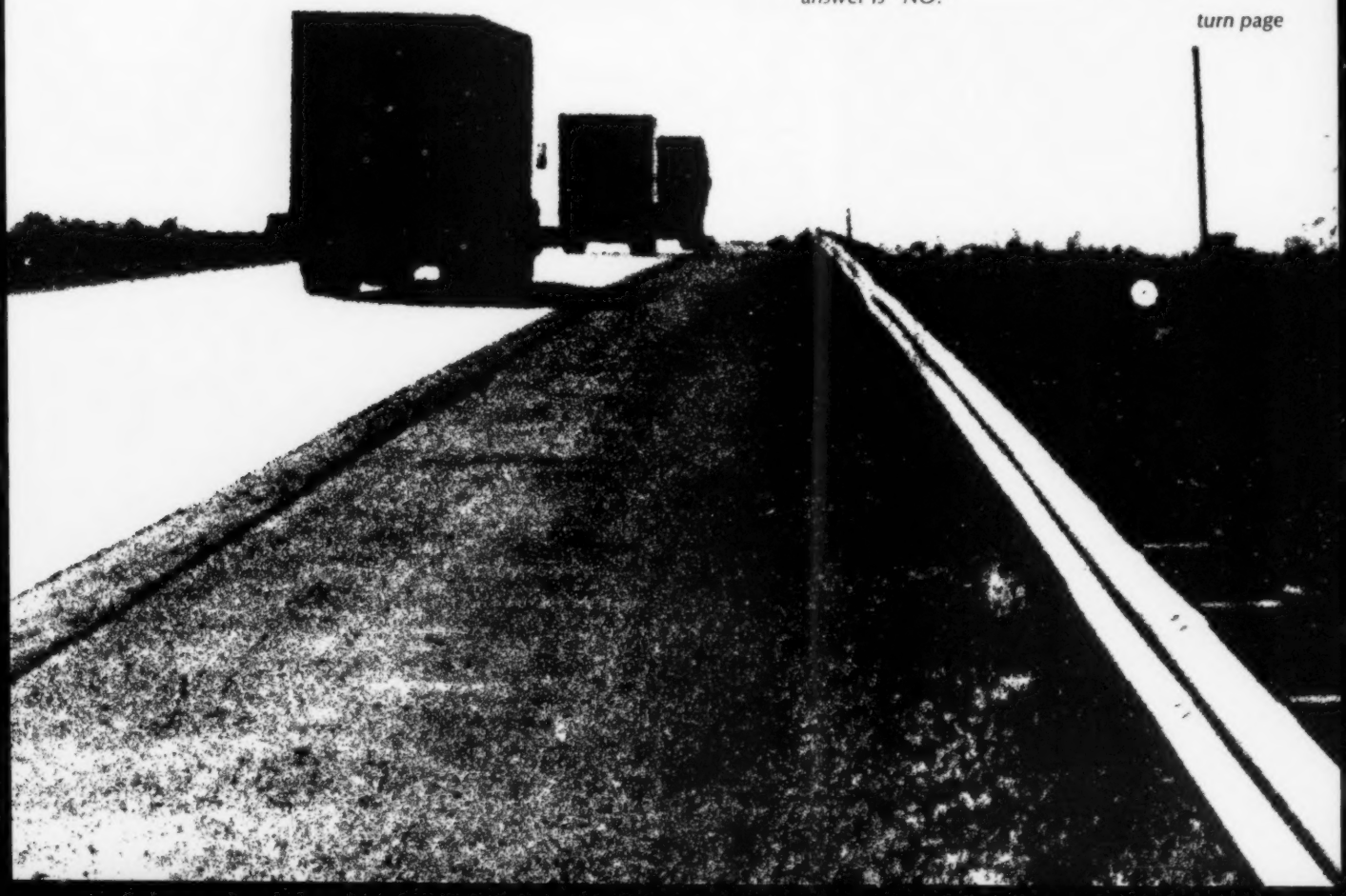



Cincinnati
62 MILES
100 KILOMETERS

The ideal for Americans in going metric is to learn to "think metric" as rapidly as possible.

PERHAPS the biggest—though certainly not the hardest—problem that the U.S. faces as we go metric is that all American citizens, other than young children, will have to learn a new system of weights and measures to supplement the one they are familiar with. This may seem very difficult, even though our customary system is complex and hard to remember. (Do you recall how many square feet are in an acre, or acres in a square mile?)

To help Americans adjust to a new way of thinking, many people feel that a slow, gradual approach, introducing metric a little at a time, will be helpful. For example, road signs could give speed limits in both miles per hour and the new kilometers per hour until motorists are familiar with the metric speeds.

How effective would this be? The United States enjoys few advantages in being the last industrialized country to go metric. (In the entire world, only Brunei, Burma, Liberia, and Yemen are left.) However, one advantage is that we can learn from the experiences of other countries that have just gone through the process of changing. Here are some relevant experiences:

- In England, there was a move about 12 or 13 years ago to present dual weather information until the public learned Celsius. Currently, both Fahrenheit and Celsius are *still* being given. British citizens are only hearing Fahrenheit—even if it is given second—because it is the one they are most familiar, and thus comfortable, with.
- In Canada and Australia, a decision was made to present dual weather reports for a short period—two to four weeks. After that time, only metric was given. Although there was the expected initial uneasiness on the part of the general public, people were able to adjust quickly and learn to "think metric" when they had to.
- In Australia, and just last fall in Canada, speed limit and distance signs on the highways were replaced by wholly metric signs over a period of several weeks. There were no reported accidents or other problems. No one confused 90 kilometers per hour (equal to 56 miles per hour) with 90 miles per hour.

In Canada and Australia, consumer acceptance of both weather and highway sign changes was high, as is the general acceptance of metric conversion. In England, where they have had no successful experiences, consumer acceptance of metric is lower.

The general lesson for the United States from these experiences is clearly that dual usage is not helpful in teaching the metric system. In fact, it even seems to slow its acceptance. For example, which system looks most appealing on a label that reads "1 quart; 0.946 liter"? Nevertheless, there do seem to be some areas where dual usage may be necessary.

First, there are instances when the lack of a thorough understanding of the new units could cause a safety hazard, as in cases of bridge clearances on the highway and weather data concerning tornadoes or hurricanes. For an indefinite period of time, such information may need to be presented in metric followed by customary to insure that any temporary confusion over the new system, perhaps heightened by a stressful situation, is not harmful.

Another area where dual usage will be needed is on labels for packaged consumer goods. This is already a common practice, done in part to facilitate the exporting of U.S. goods. Even though it will not *teach* metric, dual usage will be increasingly useful as new even-sized metric packages appear. It will help shoppers compare prices between metric-sized and customary-sized items. Such comparisons may be difficult enough now, but imagine the problem if one can of beans was only marked "13 ounces, 41¢" while another can from a different company was only marked "400 grams, 43¢." Fortunately, present federal and state laws now prohibit labels on packaged consumer goods that do not show customary units. Therefore, the metric can would be labeled "400 grams; 14.1 ounces," and comparison would be possible, thanks to dual usage.

The ideal for Americans in going metric is to learn to "think metric" as rapidly as possible. This will avoid the confusion of making conversions and also avoid the negative impact of uneven numbers. Though there will be a few instances when dual measurement will be required, the overall acceptance of metric and the efficiency of the conversion process can be enhanced by limiting this practice as much as possible. □

Metric Speakers are available

by John Tascher

DO you need someone to speak about the metric system and metrication to your civic organization, church group, school, factory, or business? Such an individual is available to you, perhaps even in your own locality. These people are members of the National Metric Speakers Bureau.

The National Metric Speakers Bureau was established by the National Bureau of Standards' Metric Information Office in January 1976. It was initiated in response to the rapidly growing interest in the metric system and metrication, caused in part by the Metric Conversion Act of 1975. NBS was getting large numbers of requests for metric speakers for seminars, conferences, classes, service clubs, and training sessions. As a result, the Metric Information Office invited, through personal contact and metric-related national organizations, persons knowledgeable about the metric system to volunteer as members of a speakers bureau.

The registered number of speakers in December 1977 was 270, including at last one in every state. NBS supplies a script for a suggested talk and other materials to each volunteer. The Bureau also occasionally sends a newsletter, "Current Metric Activity," as an update on metric developments so that presentations can be kept current. The Bureau does not provide grants, contracts, or compensation to the members of the Speakers Bureau.

A list of the volunteers can be obtained by writing to the National Bureau of Standards.* You may use this list to locate a member of the Speakers Bureau in your area. Volunteers make every reasonable effort to assist, but they are under no obligation to do so. Any details concerning expenses should be resolved between the group and the speaker. Many of the speakers request that travel expenses be paid, especially when they are asked to address a distant group.

If you want a speaker in a specialized field of metric interest (for examples, architecture, business and management, drug industry, hospitals, baking industry, machine shops), you may want to contact American National Metric Council (1625 Mass. Ave., N.W., Washington, D.C. 20036) directly for the name and address of a qualified individual.

A survey of those participating in the Metric Speakers Bureau was conducted during November and December 1976. The purpose was to determine how the Speakers Bureau is working, and how it can be made to work better. Of the 273 registered speakers at that time, 197 replied (a rate of return of 72.2 percent). In one year, about 1580 requests had been made collectively to the responding volunteers. Of these, the speakers accepted about 1330 invitations for a rate of acceptance of about 85 percent. About 40 percent of the respondents reported that they are reimbursed for their expenses (usually travel expenses when they go out of the local area). Eighteen respondents thought that additional speakers were needed in their areas.

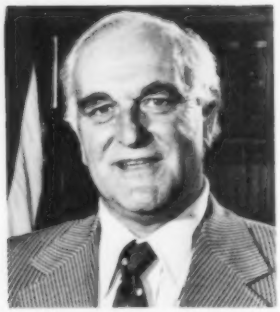
Of the 197 who replied to the survey, 164 (or 83 percent) were satisfied with the materials provided by NBS for the presentations, 22 (or 11 percent) were not satisfied, and 11 (or 6 percent) were uncertain. The speakers described numerous ways in which NBS could be of further assistance. They also pointed out many areas in which they needed more information.

The results of the survey were published in NBS Technical Note 960, "A Survey of the National Metric Speakers Bureau," issued in November 1977. (This publication is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Order as SD Cat. No. C13.46:960; the cost is $2.30.) This Technical Note also gives a rundown of the sources of information on the metric system and metrication in those areas where the speakers asked for additional information. □

Tascher is metric coordinator for the NBS Metric Information Program.

* Address inquiries to the Office of Weights and Measures, NBS Washington. D.C. 20234.

Ambler Becomes NBS Director



ON February 3, 1978, Dr. Ernest Ambler became the eighth director in the 76-year history of the National Bureau of Standards. He had been acting director since July 1975.

The appointment followed confirmation of Ambler's nomination by the U.S. Senate and acceptance of President Carter's Commission of Office.

In commenting on his appointment, Ambler said, "I am proud to have had the opportunity to be associated with this outstanding institution and look forward to working with its talented and dedicated staff in the years ahead."

"Our scope of service is continually broadening to meet new technical challenges," the director added. "In the face of this ever-changing scene, I pledge to retain a base of competence, skill, and dedication that will allow us to serve these needs with distinction."

As director of NBS, Ambler leads the nation's central measurement and reference laboratory. The Bureau's headquarters are in Gaithersburg, Maryland, with a second laboratory at Boulder, Colorado. Total staff numbers about 3500, over half of whom work in scientific and technical areas.

Ambler joined NBS in 1953 as a research physicist. As a scientist, he has contributed directly to the state-of-the-art in measurement technology. His expertise in nuclear physics and cryogenics formed the basis in 1956 for a cooperative effort that disproved the law of conservation of parity, a concept that nuclear scientists had adhered to for more than 50 years. This pioneering project confirmed experimentally the theoretical work of Nobel Prize winners T. D. Lee and C. N. Yang.

As an administrator, Ambler has helped guide Bureau operations and policies to improve the efficiency with which NBS fulfills its mission. His administrative responsibilities began in 1961 when he was named chief of the Cryogenic Physics Section. Four years later, he was appointed chief of the Inorganic Materials Division.

In 1968, he was named director of the Institute for Basic Standards. As IBS chief, Ambler directed the most basic of NBS research activities: developing and maintaining standards and measurement techniques for such quantities as length, mass, time and frequency, and temperature.

In 1973, Ambler was appointed deputy director of NBS and became responsible for assessing the technological competence of Bureau programs and for unifying the approach to budgeting and programming. The result has been a simplified budget structure and a budget which is more readily understandable at all levels of review.

Ambler has had a continuing interest in NBS' international programs which can support U.S. foreign commerce through standardization activities. In 1972, he was elected U. S. representative to the International Committee for Weights and Measures. He also serves as chairman of the international organization's Consultative Committee for the Standards of Measurement of Ionizing Radiations.

Ambler received the President's Award for Distinguished Federal Civilian Service in 1977 and has won numerous other honors. They include the Department of Commerce Gold Medal, the NBS Stratton Award, a Nuffield Fellowship of Oxford University, the John Simon Guggenheim Memorial Foundation Fellowship Award, the John Price Wetherill Medal of the Franklin Institute, the Washington Academy of Sciences Award, the Arthur S. Flemming Award, and the William A. Wildhack Award.

He is also a fellow of the American Physical Society, a member of the Board of Directors of the American National Standards Institute, and a member of the American Association for the Advancement of Science. As director of NBS, Ambler also serves ex officio as president of the National Conference on Weights and Measures. He has authored 51 publications and holds a patent for low temperature refrigeration apparatus and processes.

Born in Bradford, Yorkshire, England, in 1923, Ambler earned B.S., M.A., and Ph.D. degrees in physics at Oxford University before coming to the United States. He became a U.S. citizen in 1958.

Ambler and his wife, Alice Seiler Ambler, were married in 1955. They live in Bethesda, Maryland, with their two sons, Christopher and Jonathan. □

STANDARDS STATUS

CLEANER AIR DEPENDS ON ACCURATE MEASUREMENTS

by Madeleine Jacobs

Clean air is an expensive proposition. According to the President's Council on Environmental Quality, the nation will spend $166 billion on air pollution abatement for the decade 1974 to 1983. But the alternative to clean air is also expensive. Air pollution damages plants, crops, and property. It causes or aggravates respiratory and other diseases. It affects land values and the aesthetic value of recreational facilities. Although the economic losses associated with air pollution are difficult to assess, estimates of these costs range from $5 to $35 billion a year.

In efforts to control air pollution, Congress passed the Clean Air Act of 1970 and later supplemented it with additional stringent requirements. For example, the Act and its amendments called for a 90 percent reduction in emissions of oxides of nitrogen, carbon monoxide, and hydrocarbons from auto exhausts. In addition, the Environmental Protection Agency (EPA) was charged with setting air quality standards for six major classes of pollutants—ozone, hydrocarbons, nitrogen oxides, carbon monoxide, sulfur dioxide, and particulates. The state and local governments are responsible for ensuring compliance with these standards.

In developing air pollution abatement strategies, reliable measurements of pollutants are a must. Such measurements are needed to determine the relationship between air quality and health, the extent to which industries comply with standards, the effectiveness of pollution control strategies, and long term trends in air quality.

Since 1970, the National Bureau of Standards has been providing improved measurement techniques and standards, and improved calibration methods and services for environmental measurement systems in support of air pollution abatement programs. NBS has developed more than 50 Standard Reference Materials (SRM's) and methods useful in air pollution measurements. EPA now requires that the calibration standards used in air pollution reference methods be traceable to NBS SRM's wherever possible.

Jacobs is a writer and chief of the Editorial Section.

The SRM's are developed in cooperation with the groups that use them, according to Jimmie Hodgeson of the NBS Office of Air and Water Measurement. These groups include federal agencies such as EPA, state and local governments responsible for compliance monitoring, and affected industries.

Standards have been developed in four major application areas: the automobile industry, ambient air monitoring, stationary source monitoring, and special measurement problems.

The need for standard gases for the auto industry dates back to meetings held in 1971 between EPA, NBS, representatives from the auto companies, engine manufacturers, and specialty gas producers. The consensus was there was a need for standard reference gases for analyzing emissions from automobile exhausts.

Various calibration standards were being used throughout the industry. As a result, industry and EPA could not determine whether a difference in measured concentrations was real or an artifact of an incorrectly calibrated instrument. To place all measurement systems on a common basis, so that one measurement could be compared correctly with another, NBS developed a series of standard reference gases: propane in air (SRM's 1665-1669), carbon dioxide in nitrogen (SRM's 1673-1675), carbon monoxide in nitrogen (SRM's 1677-1681), and nitric oxide in nitrogen (SRM's 1685-1687).

In a related development, NBS also issued a set of SRM's to promote more accurate measurements of fuel consumption of internal combustion engines. This series of gases, carbon dioxide in nitrogen (SRM's 2619-2626), differs from the emission reference gases described earlier in concentration and intended use. SRM's 2619-2626 are used for calibrating instruments that make very high accuracy measurements of carbon dioxide, the major constituent of auto exhaust and the basis for fuel consumption tests.

For monitoring pollutants in ambient air, NBS has completed a number of SRM's, including sulfur dioxide (SRM's 1625-1627) and nitrogen dioxide (SRM 1629) permeation tubes for calibrating instruments used to measure these pollutants. Two additional SRM's, methane in air (SRM 1658, 1659) and methane and propane in air (SRM 1660), were completed last year. They are intended for calibrating instruments and techniques used to analyze the hydrocarbon content of the air.

NBS has also prepared SRM's for monitoring stationary pollution sources, such as industrial stacks. Sulfur dioxide reference gases (SRM 1661-1664) have been developed and SRM's for nitrogen dioxide and oxygen are in the works.

In the area of special applications, NBS has been working on SRM's and standard methods for monitoring such pollutants as chlorofluorocarbons (which are used in aerosol propellants) and vinyl chloride, an important industrial chemical. NBS is currently in the process of evaluating measurements of identical samples of nitrous oxide and chlorofluorocarbons in a collaborative test involving 25 laboratories around the world. The evaluation should give an indication of the precision with which these chemicals are now being measured.

For monitoring ozone at ground level—a potent pollutant—NBS developed a measurement standard in the form of an ultraviolet photometric instrument against which transfer standards have been compared.

"As the 'easier' standards are developed, we are turning our interests to more difficult problems," Hodgeson notes. For example, NBS is now working on SRM's for physical and chemical characteristics of atmospheric particulates 1 micrometer in size and smaller. These are particles thought to be important in causing or aggravating respiratory diseases.

Additional information on the NBS Air Pollution Measurements Program may be obtained by writing Dr. Jimmie Hodgeson, Office of Air and Water Measurement, National Bureau of Standards, Washington, D.C. 20234 (Telephone 301/921-3775).

Inquiries regarding the availability and prices of SRM's mentioned should be directed to: Office of Standard Reference Materials, National Bureau of Standards, Washington, D.C. 20234. (Telephone: 301/921-2045).

STAFF REPORTS

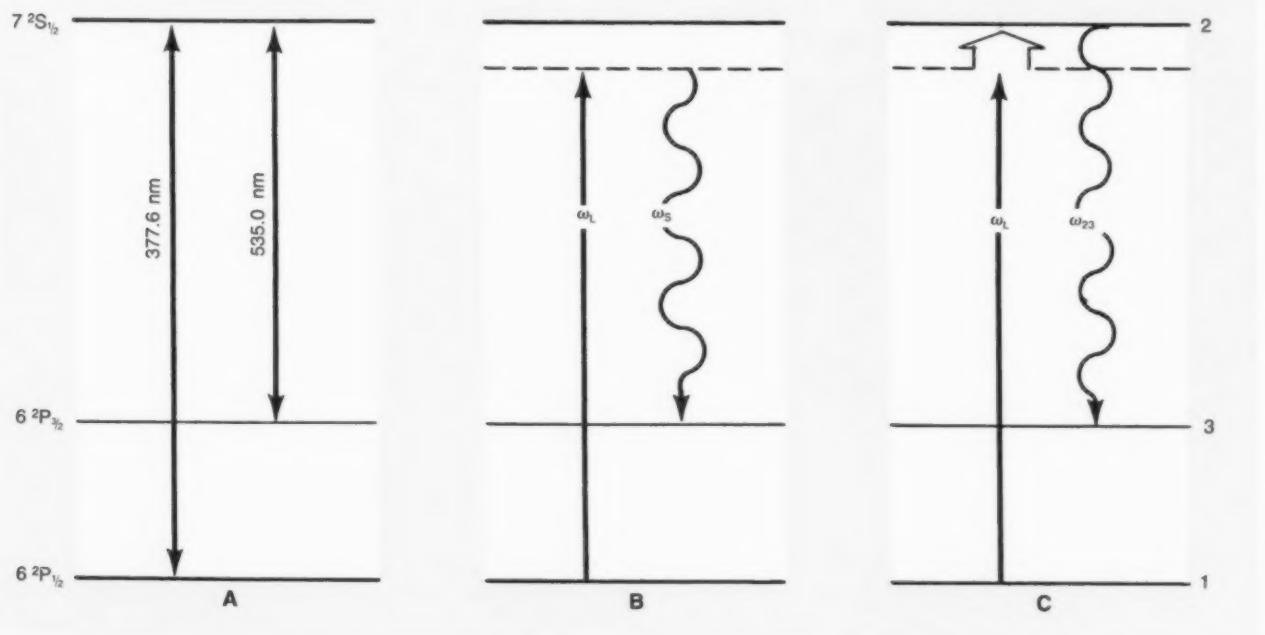
STIMULATED COLLISION-INDUCED FLUORESCENCE OBSERVED

John L. Carlsten, Joint Institute for Laboratory Astrophysics (JILA), A404, Boulder, Colo., 303/492-8186, and Michael G. Raymer, JILA, B024, University of Colorado, 303/492-8186.

Recently there has been considerable theoretical and experimental interest in near-resonant scattering of laser light. A number of research groups are studying the effects of high laser intensities and detuning of the laser from resonance, as well as the effects of collisions on the absorption and emission processes. As a result, a new field has developed which is concerned with the various collisional processes which can occur in the presence of strong laser fields. The Joint Institute for Laboratory Astrophysics (NBS/University of Colorado) entered the new research area in 1976 with the first observation of collisional redistribution. Continuing this program, we have studied the emission from a "three-level" atom, thallium, during the collision with an argon atom in the presence of laser light tuned near the 377.6-nm resonance line (figure 1).

We have been studying the emission that occurs near the 535.0-nm line of thallium and find that two emission components are present. The first, which occurs even in the absence of collisions, is at ω_S, the Stokes frequency and is known as Raman scattering. The second component is the result of the thallium atom colliding with an argon atom in the presence of the laser field and producing a $7S_{1/2}$ excited state. Most of the energy needed to excite the thallium atom to the $7S_{1/2}$ state comes from the photon, with the difference being provided by the collision process. The resulting emission at ω_{23} is known as collision-induced *fluorescence*. The dependence of the collision-induced fluorescence and Raman scatter-

Figure 1—*a) First three energy levels of thallium. With the laser tuned near the 377.6-nm resonance line, we observed scattered light near the 535.0-nm line. b) Schematic representation of electronic Raman scattering at the Stokes frequency ω_S from an incident laser at frequency ω_L. c) Schematic representation of collision-induced fluorescence. Collisions (which in our case were Tl-Ar collisions) transferred Tl atoms from the laser-induced virtual level to level 2, resulting in fluorescence at ω_{23}. When level 3 is initially unpopulated, both of these components can become stimulated.*



ing on such parameters as collision rates, laser intensity, and detuning is called the "redistribution function" and is important in the theory of radiative transfer in spectral lines.

The chief characteristic of light scattering by a three-level atom is the possibility of stimulated emission. We have observed the growth of both of these emission components (near the 535.0-nm emission line) from the linear (with pump laser intensity) regime, where the scattering is spontaneous, to the exponential regime, where the scattering becomes stimulated. In addition, we have studied the collisional dependence of the emission. Recently, stimulated Raman scattering in vapors and gases has been used by a number of researchers as an efficient means of down conversion of coherent radiation to lower frequency. Our study here is an effort to understand the effects of collisions on such stimulated scattering.

To do the experiment we used a N_2 laser to pump a dye laser, which was tuned near the 377.6-nm resonance line of thallium. The thallium and argon were contained in a high temperature oven with a side window for detection and analysis of the scattered radiation at 90° as well as in the forward direction. The intensity of the laser inside the oven was 2 MW/cm^2. Typically the vapor pressure of the thallium was 0.1 torr (13 Pa) and the pressure of the argon was 20 torr (2.7 kPa).

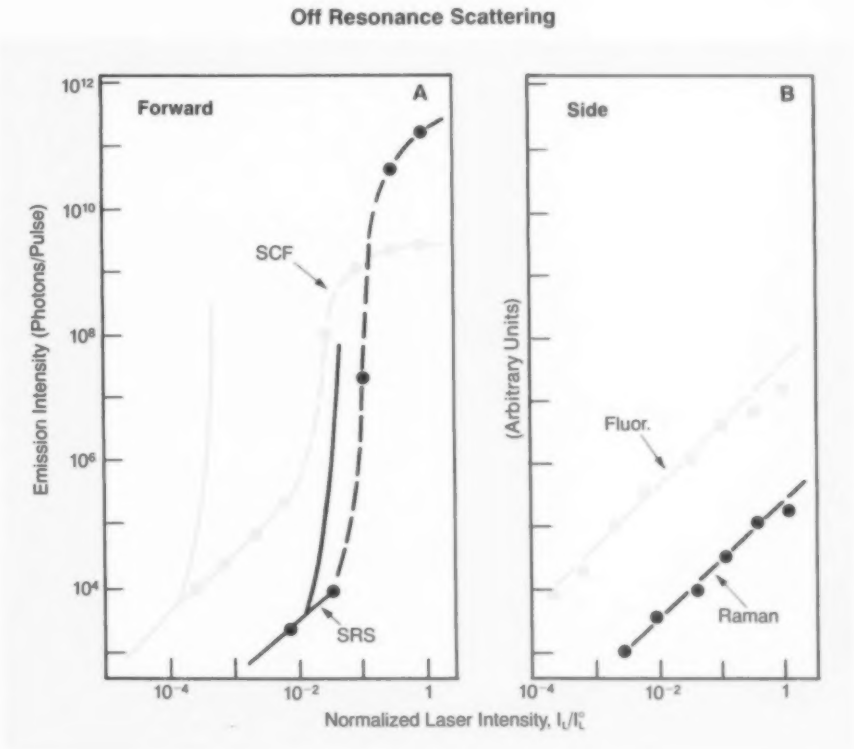
The dependence of the Raman scattering and collision-induced fluorescence on laser intensity is shown in figure 2. The laser was 0.14 nm to the red side of resonance. In the side direction (figure 2b), both the Raman scattering and collisional induced fluorescence were linear in laser intensity. By measuring the ratio of these two components we were able for the first time to obtain a direct, absolute measurement of the redistribution function.

In the forward direction, as in the side direction, the emission is initially linear at low intensities. However, eventually both the Raman eimssion and the collision-induced fluorescence grow exponentially when the scattering becomes stimulated. At still higher intensity, saturation occurs. Using photon propagation, we have calculated the expected exponential growth for the Raman scattering and collision-induced fluorescence.

The predicted initial exponential growth of the Raman scattering is quite close to our experimental results; the gain for the collision-induced fluorescence is more than an order of magnitude less than predicted by steady-state theory. We do not know the reason for the discrepancy, but we believe that the main contribution comes from our use of the steady-state model for the photon propagation.

In future studies, we will try to determine the mechanisms responsible for the saturation observed at high laser intensities (Figure 2a). We are also interested in trying to determine how the gain of the two stimulated components depends on various laser parameters, such as band width, mode structure, and focusing.

Figure 2—*Dependence of Raman scattering and collision induced fluorescence on laser intensity when the laser was tuned off resonance. a) Growth of the stimulated Raman scattering(SRS) and stimulated collision induced fluorescence (SCF) from spontaneous, linear scattering in the forward direction. The solid curves are theoretical curves. b) Spontaneous, linear scattering in the side direction for comparison.*



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LASER-RAMAN PROBE MICROANALYSIS OF BIOLOGICAL TISSUE

Edgar S. Etz and Kurt F. J. Heinrich, Analytical Chemistry Division, A115 Chemistry Building, 301/921-2862.

The analysis of biological specimens presents the microanalyst with a more difficult problem than with most microscopic samples. In the past, scanning electron microscopy and electron probe microanalysis have been used to obtain both morphological and compositional information from biological specimens. These methods, including the more recently introduced ion microprobe mass analyzer, can, however, reveal relatively little information beyond the determination of elemental composition. There has been no method for performing organic chemical microanalysis *in situ* in biological tissues for correlation with morphological features.

The capability of micro-Raman spectroscopy for molecular characterization—at the microscopic level—of non-biological samples has been described previously.* Recently we have explored its potential for the microanalysis of organic molecular species in biological tissues and cells. The aim of these investigations was to determine whether Raman spectra could be obtained from microscopic regions, and, if so, whether this information could be correlated with the more conventional morphological and x-ray microanalytical methods. Information regarding the precise distribution, relative abundance, and molecular identity of the constituents in such biological matrices would be a significant contribution towards understanding many essential tissue and cellular processes.

We have examined thin (5–10 μm thickness) sections of cartilage, bone, and tooth. This research was performed in collaboration with workers at the NIH National Institute for Dental Research. Of interest are the processes leading to the calcification of tissues and the premineralization of bone. Studying these processes requires the ability to distinguish between organically and inorganically bound calcium and phosphorus.

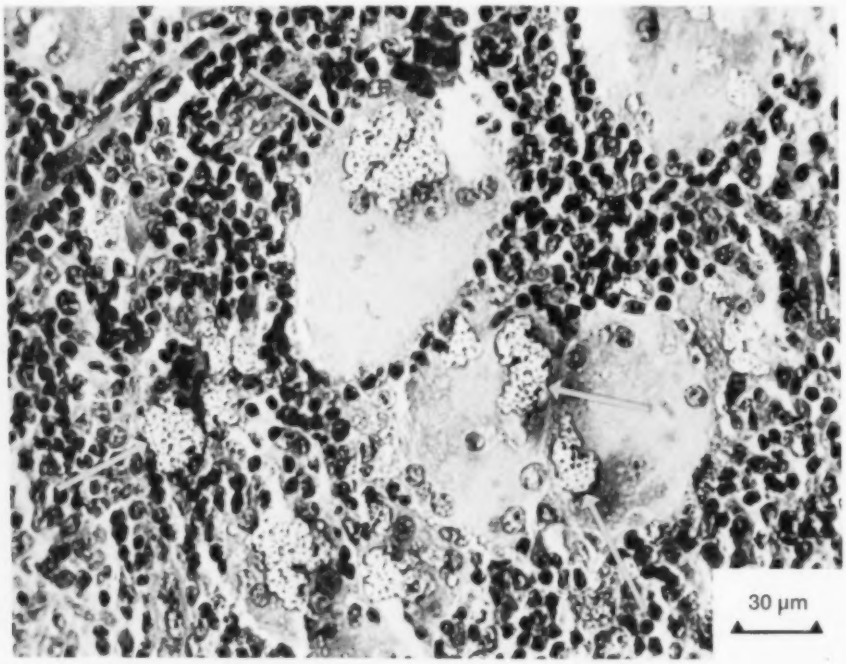

Figure 1—*Thin (5 μm) section of lymph node tissue with foreign bodies of silicone rubber within multinucleated giant cells. Light microscope, magnification 320X. Stained (hematoxylin-eosin). Arrows indicate location of several typical silicone microparticles.*

* The May 1976 issue of DIMENSIONS carried a report on the development at NBS of a unique laser-Raman microprobe designed to enable the spectroscopic analysis of microsamples, and of microparticles in particular. In this new instrument, single particles—supported by a suitable substrate—are moved into the focal point of a laser beam (utilizing any one of several "excitation" frequencies in the visible region of the spectrum) and the light scattered by the sample is analyzed for its spectral content. The scattered light contains the Raman spectrum of the particle which is diagnostic of molecular and crystal vibrations in the solid. Particles, as other microscopic samples or sample regions, composed of a broad range of inorganic compounds, organic solids, and polymers show the normal Raman effect and can therefore be identified as to principal molecular constitutents. The application of Raman spectroscopy to single particle analysis thereby offers the opportunity for the chemical speciation of major elements and provides a new insight into the microscopic domain unattainable by other microprobes. The new instrument and technique have been applied to the investigation of diverse problems in microanalysis; one such study, on power plant stack particulates, was highlighted in the August 1977 issue of DIMENSIONS.

An inherent major difficulty in work on the non-destructive analysis of biological tissue lies in the preparation of the tissue. The specimen has to be prepared in such a way that the morphology and the *in vivo* distribution of the tissue and cellular components are preserved. For this reason, much attention was given to developing methods of sample preparation for subsequent Raman microanalysis. We had mainly examined freeze-dried tissue sections and had gained some limited experience in the analysis of chemically fixed sections and specimens embedded in plastics and in non-interfering hydrocarbon fluids (to retain tissue and cell water).

These studies furnished good Raman spectra of a number of tissue components, including spectra of various forms of collagen (a fibrous protein) in cartilage and other similar types of tissue. Forms of mineral phosphate have been characterized in microscopic regions of embryonic chick bone tissue and in mineralized zones of rat incisor dentine. The results of these studies were very encouraging and indicated that many problems could be dealt with using micro-Raman analysis.

In a related study, the Raman microprobe has been used to furnish information for pathology studies. Commonly, the studies performed by conventional techniques are to provide identification of elements and compounds "naturally" occurring in tissue both in the normal and diseased states. In cases where foreign material has been introduced, the distribution and identity of particles or dissolved species must be known.

For this work, thin sections of lymph node were obtained from pathologists at the University of California, San Diego. These samples were suspected (from conventional optical microscopic examination and elemental x-ray microanalysis) to contain microscopic foreign particles of silicone polymer. The biopsy tissue was one from a patient with axillary lymph node complications which were suspected to be related to an implanted silicone rubber finger joint prosthesis. Histologic sections of the lymph node showed numerous giant cells, many of which contained light yellow, granular particles of irregular shape. An optical micrograph of a stained section of the lymph node is shown in Figure 1. The fragments of foreign material within giant cells vary in size from a few micrometers to about 60 μm. The measurements were performed on adjacent, unstained thin sections of the same tissue. Extracellular regions of the tissue, the cellular material and the foreign-body material were examined.

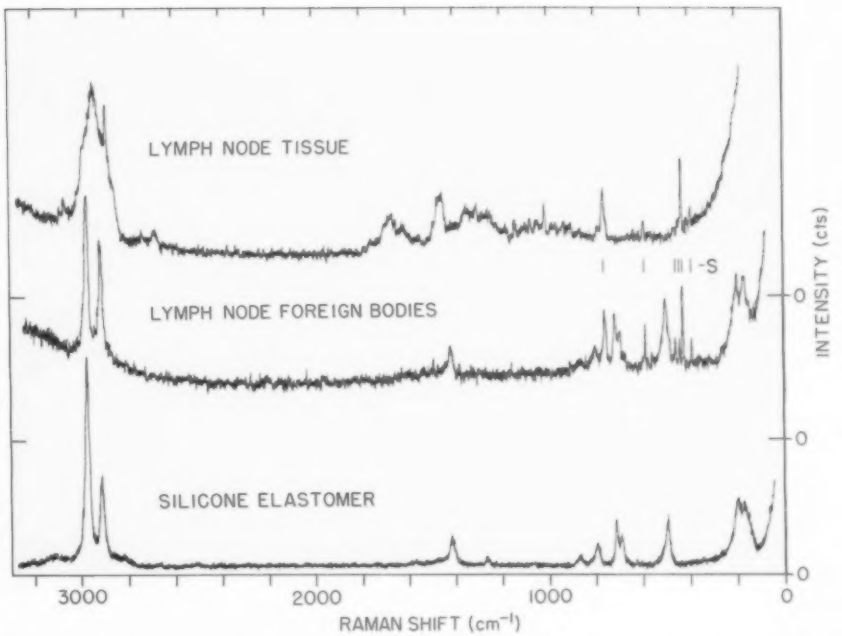

Figure 2—*Spectra recorded in the Raman probe microanalysis of a thin (5 μm) section of lymph node tissue (cf. figure 1). Top: Spectrum of the cellular material (cytoplasm) surrounding foreign bodies. Middle: Spectrum of a foreign body located within a giant cell. Bottom: Spectrum of a small particle of silicone elastomer from a joint prosthesis. Bands marked S in the top and middle spectra are due to the sapphire (α-Al_2O_3) sample substrate.*

From the spectra obtained, various molecular components of the complex biological matrix were identified (see Figure 2). The top spectrum is that of the matrix or host, the cytoplasm. The middle spectrum is from one of the many foreign particles in the tissue. The foreign body examined here was approximately 16 μm in size. The middle and bottom spectra have enough points of similarity to unequivocally identify the foreign bodies as silicone particles. The bottom spectrum was obtained from a particle abraded from a new silicone elastomer prosthesis and is characteristic of polydimethylsiloxane polymers (silicone rubber and gel). This is the first time that the molecular composition of material intruding in biological tissue has been documented by an instrumental microanalytical technique. These findings support other medical evidence that fairly large microparticles can migrate from an intact and normally functioning prosthesis to a distant lymph node. Complications of silicone implants are known and the dispersion in such cases of silicone material either into adjacent tissue or in body tissue away from the site of the implant has been suspected previously.

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NEW PHASE TRANSITION IN OXYGEN DISCOVERED

Hans Roder, Cryogenics Division, 1126 Cryogenics Building, Boulder, Colo., 303/499-1000, ext. 3528.

Evidence for solid-solid transition in oxygen quite close to the triple point has been obtained recently through a detailed study of the melting process. The real impetus to suspect a hidden phase transition stemmed from an extensive review and study of discrepancies in experimental and analytical values of the molar volume of γ-oxygen at the triple point.

Both heating and cooling curves were obtained in a conventional specific heat apparatus for a temperature range slightly below to slightly above the triple point temperature. Indications of a possible phase change, i.e., dips in temperature, were observed which were quite sharp, The dips are taken to indicate the onset of melting. In other words, as the temperature is raised, γ-oxygen transforms to δ-oxygen at 0.0008 K below the triple point, and it is the δ-oxygen that melts to form the liquid.

The transition has not been observed previously because the temperature difference between the new transition and the triple point is so small. To achieve the transition, the gradient across the sample must be very small, i.e., on the order of 1 mK or less. Larger gradients will obscure the transition because the thermal conductivity of the liquid is considerably greater than that of the solid, and once a liquid film is formed, subsequent heat transfer seems to occur only through the liquid.

The triple point of oxygen is one of the primary fixed points defining the International Practical Temperature Scale (IPTS-68), and as such is used in the calibration of thermometers. The achievement of this reference temperature in any given thermometer calibration system must now be considered to be uncertain by approximately 0.0008 K because, depending on the technique used, one could achieve either the γ-δ transition, or actual melting, δ-liquid.

NBS EXPANDS DATA FOR SPACE SHUTTLE

Neil A. Olien, Cryogenics Division, Room 2-0123, 303/499/1000, ext. 3257, Boulder, Colo.

Thermodynamic and related properties measurements have been completed by NBS for oxygen and parahydrogen to 80 MPa, and extrapolated to 100 MPa (14, 500 psi) over the temperature range from their triple point to 300 K.* Correlating functions were used to fit, smooth, and interpolate the data and to produce tables of properties.

In addition, NBS is determining the thermal diffusivity of oxygen in support of NASA's request. Laser light scattering spectroscopy measurement techniques are being used to obtain the thermal diffusivity data in the extended critical region. Previous data acquisition with the apparatus focused on methane, the major component of LNG (liquefied natural gas).

The laser light scattering approach also permits measurements of sound velocities. In addition, the feasibility of obtaining data on binary mixture diffusion coefficients has been demonstrated with the apparatus.

The apparatus consists of a high pressure optical cell, a cryostat refrigerated with liquid nitrogen, an argon ion laser and low-level light detection equipment.

In the optical cell, fluctuations of the fluid are identified by scattered light. Analysis is by digital autocorrelation techniques for Rayleigh light scattering (the examination of the very narrow lines associated with temperature fluctuations) or by a scanned Fabry Perot interferometer for Doppler frequency shift measurements associated with the scattering from density (pressure) fluctuations (Brillouin scattering). Located inside the scattering cell, a highly stable capacitor permits determination of the dielectric constant and the density of the scattering fluid. Photon-counting and digital autocorrelation analysis interfaced with a computer enable on-line data accumulation and analysis.

The measurement range of this apparatus extends from outside the critical range to within most of the critical range (154 to 180 K and 10 to 17 mol/L for oxygen). Measurement inaccuracy is about 5 percent in the critical region, investigations have shown, increasing to 10 percent or greater further away. Outside the critical region, investigations have shown that temperature gradients and impurities do not affect measurements beyond the experimental accuracy.

* L. A. Weber, Thermodynamic and Related Properties of Oxygen from the Triple Point to 300 K at Pressures to 1000 Bars, NBSIR 77-865 (1977), and, L. A. Weber, Thermodynamic and Related Properties of Parahydrogen from the Triple Point to 300 K at Pressures to 1000 Bars, NASA SP-3088/NBSIR 74-374 (1975).

Budget Increase Requested for NBS

A total of $94 364 000 is included for the National Bureau of Standards in the budget of the United States for Fiscal Year 1979.

The budget request is $22 818 000 above the FY 1978 operating level of $71 546 000. The 32 percent increase in funding is aimed at strengthening research on physical measurements, basic science, and materials and at developing computer standards.

According to Dr. Ernest Ambler, the NBS director, "If appropriated by Congress, this will be the largest dollar increase in the history of the Bureau. The additional funding would allow NBS, as the nation's central measurement and reference laboratory, to rebuild state-of-the-art capabilities in various areas of technical competence and to acquire the necessary experience to carry out additional fundamental research in basic areas."

The budget for NBS could total $155 million in FY 1979, up from $136 million for the current fiscal year. The total figure includes the requested direct congressional appropriation, money acquired for reimbursable work which NBS performs for other federal agencies and the public, and sales of Bureau goods and services such as Standard Reference Materials and calibrations.

ESTIMATED NBS OPERATING FUNDS

(Congress only)
(in millions of dollars)

	FY77 (actual)	FY78 (estimate)	FY79 (request)
Provide basis for a national system for physical measurement	28.8	28.4	32.4
Physical measurements, units and standards	20.3	19.4	23.1
Reference measurements for physical quantities	8.5	9.0	9.3
Provide services to improve use of materials	19.7	19.6	22.2
Properties and performance of materials	15.8	15.6	19.9
Reference materials	.9	1.0	1.1
Environmental pollution measurements (Air, water, and noise)	3.0	3.0	1.2
Provide services to improve the application of technology	10.1	9.3	12.7
State weights and measures services	.6	.7	.7
Voluntary engineering standards	1.7	2.3	2.5
Building science and technology	4.3	4.2	4.4
Electronic technology	1.0	1.1	1.1
Product technology	2.5	1.0	1.1
Cooperative technology	—	—	2.0
Central planning	—	—	.9
Improve the application of computer technology	6.5	6.4	21.0
Experimental Technology Incentives Program	3.1	3.1	3.2
Capital transfer & facilities	.7	2.1	.4
Transfer to working capital	2.1	2.6	2.4
TOTAL	71.0	71.5	94.3

All figures are rounded.

CONFERENCES

For general information on NBS conferences, contact Sara Torrence, NBS Office of Information Activities, Washington, D.C. 20234, 301/921-2721.

NEW COMPUTING TOOLS SYMPOSIUM

"Tools for Improved Computing in the 80's" will be the theme of the 17th annual technical symposium of the Association for Computing Machinery (ACM) Washington, D.C. chapter and the National Bureau of Standards Institute for Computer Sciences and Technology.

The symposium will be held June 15, 1978 at NBS Gaithersburg, Maryland, headquarters.

It will focus not only on new computing tools but also on new applications of existing tools appropriate to the full range of users, project managers, analysts, and programmers. Papers are encouraged that describe the application of tools and techniques in many areas, including among others: auditing, career development, communications and networks, data encryption, data base, documentation, hardware and software procurement, micro processors, novel architectures, performance evaluation, physical security, professionalism, programmer productivity, programmer teams, programming, project management, requirements specification, simulation, software measurement, software reliability, software security, standards, systems design, and user involvement.

First and second prizes of $300 and $100 will be awarded for the best papers presented.

Abstracts (150 words) should be submitted with four numbered, double-spaced copies of the complete paper, to Dr. Elkins. After receipt of the papers, the schedule calls for:

- Acceptance notifications mailed—March 10
- Final, camera-ready copy due—April 14
- Symposium held—June 15

For further information contact: Dr. Bryce Elkins, Computer Sciences Corporation, 400 Army-Navy Drive, Arlington, VA 22202.

SYMPOSIUM ON RADIOLOGIC IMAGING

Symposium on Real-time Radiologic Imaging: Medical and Industrial Applications will be held on May 8-10, 1978, at the National Bureau of Standards, Gaithersburg, Md.

The objective is to acquaint members of the industrial and medical communities with the state-of-the-art in real-time radio-logic imaging technology. It is anticipated that a cross fertilization of ideas and opinions will result by bringing together people from these two important disciplines.

Emphasis will be placed on practical applications and quantification of real-time imaging methods. The capabilities of the technique, its limitations, how the technique is accomplished, the need for standards, and cost will be addressed in detail in the various invited and contributed papers. A general outline of the symposium follows:

- General Session
- Detectors: Electro-Optical, Input Screens
- Computer-Based Systems
- Contributed Papers—Poster Session
- Special Applications
- Standards
- Tours: National Bureau of Standards and Bureau of Radiological Health

Cochairmen of the symposium are Donald A. Garrett, National Bureau of Standards, Donald A. Bracher, Oldelft Corporation of America.

For further information contact: Ronald B. Johnson, B348 Materials Building, 301/921-2835.

SEMINAR ON TESTING OF SOLAR ENERGY MATERIALS AND SYSTEMS

A call for papers on methods of measurement and test facilities for solar energy materials and systems has been issued for a seminar to be held at the National Bureau of Standards in Gaithersburg, MD., from May 22 to 24, 1978.

The seminar is sponsored by NBS, the Institute of Environmental Sciences, the Department of Energy and the American Society for Testing and Materials. Its purpose is to provide the solar-energy technical community in industry and government with a forum to exchange information.

Two main topics will be terrestrial solar energy measurement and standardization of test results. Both are considered keys to characterize the thermal performance of such solar energy systems as photovoltaic, thermal power, windmills and solar collectors for heating and cooling.

The seminar seeks papers in the following or related subject areas:

- Unresolved problems in solar testing.
- Solar spectrum definition problems—normal and accelerated exposure.
- Solar radiation measurements—direct, diffuse, spectral, total.
- Solar testing experience—indoor and outdoor.
- Materials, components, systems test procedures.

For information contact: Joseph Richmond, A129 Technology Building, 301/921-2148.

CONFERENCE CALENDAR

WORKSHOP ON MOISTURE PROBLEMS, NBS, Gaithersburg, MD; sponsored by NBS and ARPA; contact: Harry Schafft, A327 Technology Building, 301/921-3625.

28TH IEEE VEHICULAR TECHNOLOGY CONFERENCE; Denver, Colo.; sponsored by NBS and the Institute of Electrical and Electronic Engineers; contact: John Shafer, NBS, Boulder, Colo., 303/499-1000, ext. 3185.

EMERGING PATTERNS IN AUTOMATIC IMAGERY PATTERN RECOGNITION; NBS, Gaithersburg, MD; sponsored by NBS and Electronic Industries Association; contact: Russell Kirsch, A317 Administration Building, 301/921-2337.

TRACE ORGANIC ANALYSIS; A NEW FRONTIER IN ANALYTICAL CHEMISTRY, NBS, Gaithersburg, MD; sponsored by NBS; contact: Harry S. Hertz, A105 Chemistry Building, 301/921-2153.

ACOUSTIC EMISSION WORKING GROUP MEETING, NBS, Gaithersburg, MD; sponsored by NBS and the AEWG; contact: John A. Simmons, B118 Materials Building, 301/921-3355.

AMERICAN NUCLEAR SOCIETY TOPICAL CONFERENCE ON COMPUTERS IN ACTIVATION ANALYSIS AND GAMMA RAY SPECTROSCOPY: Mayaguez, Puerto Rico; sponsored by NBS, American Chemical Society, American Nuclear Society, Energy Research and Development Administration, U. of Puerto Rico, Puerto Rico Nuclear Center; contact: B. S. Carpenter, B108 Reactor Building, 301/921-2167.

SYMPOSIUM ON REAL-TIME RADIOGRAPHIC IMAGING, NBS, Gaithersburg, MD; sponsored by NBS and the American Society for Testing and Materials; contact: Donald A. Garrett, A106 Reactor Building, 301/921-2167.

IONIZING RADIATION MEASUREMENT, NBS, Gaithersburg, MD; sponsored by NBS; contact: E. H. Eisenhower, C233 Radiation Physics Building, 301/921-2551.

TRENDS AND APPLICATIONS SYMPOSIUM, NBS, Gaithersburg, MD; sponsored by NBS, IEEE Computer Society; contact: Shirley Watkins, B212 Technology Building, 301/921-2061.

PROCUREMENT: MANDATED PROGRAMS UNDER RCRA AND EPCA, NBS, Gaithersburg, MD; sponsored by NBS and National Governors Association; contact: Harvey Yakowitz, B164 Materials Building, 301/921-2343.

3RD INTERNATIONAL SYMPOSIUM ON ULTRASONIC IMAGING AND TISSUE CHARACTERIZATION, NBS, Gaithersburg, MD; sponsored by NBS and National Institutes of Health; contact: Melvin Linzer, A329 Materials Building, 301/921-2858.

1ST INTERNATIONAL SYMPOSIUM ON ULTRASONIC MATERIALS CHARACTERIZATION, NBS, Gaithersburg, MD; sponsored by NBS and American Society for Nondestructive Testing; contact: Harry Berger, B252 Polymers Building, 301/921-3281.

MICROCOMPUTER BASED INSTRUMENTATION CONFERENCE, NBS, Gaithersburg, MD; sponsored by NBS, IEEE Computer Society; IEEE Group on Instrumentation and Measurement; contact: Bradford Smith, A130 Technology Building, 301/921-2381.

TOOLS FOR IMPROVED COMPUTING IN THE 80s, NBS Gaithersburg, MD; sponsored by NBS, Washington, D.C. Chapter of the Association for Computing Machinery; contact: Trotter Hardy, A367 Technology Building, 301/921-3491.

GAS KINETICS CONFERENCE, NBS, Gaithersburg, MD; sponsored by NBS and the Committee on Chemical Kinetics, NBS, Committee on Chemical Kinetics of the National Academy of Sciences/National Research Council; contact: David Garvin, B154 Chemistry Building, 301/921-2771.

CONFERENCE ON PRECISION ELECTROMAGNETIC MEASUREMENTS, Ottawa, Ontario, Canada; sponsored by Institute of Electrical and Electronics Engineers, U.S. National Committee-International tact: Dee Belsher, NBS, Boulder, Colo., Union of Radio Science, and NBS; con- 303/499-1000, ext. 3981.

FOURTH ANNUAL CONFERENCE OF THE AMERICAN ASSOCIATION FOR CRYSTAL GROWTH, NBS, Gaithersburg, MD; sponsored by NBS and AACG; contact: Robert L. Parker, B164 Materials Building, 301/921-2961.

CHARACTERIZATION OF HIGH-TEMPERATURE GASES, NBS, Gaithersburg, MD; sponsored by NBS; contact: J. Hastie, A307 Materials Building, 301/921-2859.

NATIONAL CONFERENCE OF STANDARDS LABORATORIES, NBS, Gaithersburg, MD; sponsored by NBS and the National Conference of Standards Laboratories; contact: Brian Belanger, A435 Physics Building, 301/921-2805.

CONSTRUCTION DOCUMENTATION CONFERENCE; NBS, Gaithersburg, MD; sponsored by NBS, the Construction Specifications Institute, and the Guide Specifications Committee of the Federal Construction Council; contact: Roger Rensburger, A151 Technology Building, 301/921-3126.

*New Listings

**Conference originally scheduled for March 13-15, postponed to October 24-25.

PUBLICATIONS

SPECIAL BULLETS REDUCE HAZARDOUS LEAD LEVELS IN INDOOR FIRING RANGES

The Reduction of Airborne Lead in Indoor Firing Ranges by Using Modified Ammunition, Juhasz. A. A., Nat. Bur. Stand. (U.S.), Spec. Publ. 480-26, 27 pages (Nov. 1977) Stock No. 003-003-0101-0, $1.20.

Indoor firing ranges, used by police departments and others, can be cleared of hazardous airborne lead by use of specially designed ammunition, states a report just issued by the National Bureau of Standards.

Excessive airborne lead levels at firing ranges have become a matter of concern for law enforcement officials throughout the country. Some range instructors have had to be hospitalized due to lead poisoning and ranges closed down because of the buildup of hazardous lead levels.

The current maximum safe level of airborne lead is 0.2 milligram per cubic meter of air, and at some the level is even higher.

NBS' Law Enforcement Standards Laboratory was asked to examine the problem by the Justice Department's Law Enforcement Assistance Administration. An NBS study was conducted by A. A. Juhasz of the U.S. Army's Ballistic Research Laboratories, Aberdeen Proving Ground, Md.

A 38 Special police revolver was used in the study and firings were conducted in a specially designed container which allowed particulate matter from the weapon to be trapped for subsequent analysis.

The cartridge primer and the bullet—or projectile—were found to be the primary sources of airborne lead contamination. Under ordinary range conditions, conventional 38 Special ammunition produced an average of 5,640 micrograms of particulate lead per round at the shooter's position.

When experimental ammunition, containing jacketed soft-point projectiles and a special primer composition without lead, was used the production of airborne lead was reduced to 13 micrograms per round. This was a 430-fold decrease in particulate lead emission.

The jacketed projectile—which prevents the interaction of lead with the hot powder gases—is available commercially. But the non-lead primer is still experimental and is not in commercial production. The report, therefore, recommends use of jacketed bullets.

"The use of ammunition loaded with semi-jacketed lead bullets, which are commercially available in high quality, should reduce airborne lead produced at the position of the shooter by a factor of at least 10 and possibly as much as 15," the report states.

This reduction alone should reduce airborne lead levels to or below the 0.2 milligram level now considered safe, NBS researchers believe.

At the same time, NBS recommends the development of an improved primer composition that will eliminate lead components.

PUBLISHED PAPERS OF 1977 FLOW MEASUREMENT SYMPOSIUM

Flow measurement in Open Channels and Closed Conduits, Irwin, L. K., Ed., Nat. Bur. Stand. (U.S.), Spec. Publ. 484/1 479 pages (Oct. 1977), Stock No. 003-003-01845-7, $12.25 per 2 part set; sold in sets only. Flow measurement in Open Channels and Closed Circuits, Irwin, L. K. Ed., Nat. Bur. Stand. (U.S.), Spec. Publ. 484/2, 490 pages (Oct. 1977), Stock No. 003-003-01845-7, $12.25 per 2 part set; sold in sets only.

From water and sewage to oil to air to liquefied natural gas, the state of the art of fluid flow measurement can be found in a new two-volume publication from the National Bureau of Standards.

The volumes contain over 50 papers presented at the 1977 NBS Flow Measurement Symposium last February. Topics include fluid modeling, instrument technology, instrument errors and techniques for reducing these errors, and field methods and international standards for flow measurement. The subject matter ranges from the abstractions of basic theory to the pragmatics of international metrology negotiation.

Errors and uncertainties in flow measurement are becoming increasingly important—especially in the metering of liquid fuels, where very substantial sums of money are involved. With improved instrumentation and computing ability, it is increasingly possible to avoid these errors. Both producers and users of flow measurement technology attended the 1977 symposium to discuss these and other issues, such as international standards and flow measurement for regulatory purposes.

Some presentations of outstanding interest contained in these papers include:

—the errors produced by swirl effects in turbine-meter readings;

—promising advances in the use of sonic and ultrasonic flowmeters, and non-intrusive laser techniques;

—varied techniques and novel applications of anemometry;

—updated theory and performance of orifice plates, weirs, and flumes;

—a transducer system for in-line automobile fuel monitoring; and

—a varied round-table discussion of different aspects of international flow-measurement standardization.

The symposium included invited speakers from the American Petroleum Institute, N.V. Nederlandse Gasunie (Groningen, Netherland), the U.S. Federal Energy Administration (now part of the Department of Energy), the National Engineering Laboratory (East Kilbride, Scotland, U.K.) and the National Bureau of Standards.

Building Technology

Fattal, G., Simiu, E., and Culver, C., Observations on the Behavior of Buildings in the Romania Earthquake of March 4, 1977, Nat. Bur. Stand. (U.S.), Spec. Publ. 490, 168 pages (Sept. 1977) Stock No. 003-003-01841-4, $3.

Leyendecker, E. V., Ellingwood, B. R., Design Methods for Reducing the Risk of Progressive Collapse in Buildings, Nat. Bur. Stand. (U.S.), Bldg. Sci. Ser. 98, 68 pages (Apr. 1977) Stock No. 003-003-01765-5, $1.30.

Olmert, M., Building Technology Project Summaries 1976, Nat. Bur. Stand. (U.S.), Spec. Publ. 446-1, 83 pages (Sept. 1977) Stock No. 003-003-01846, $2.20.

Computer Science and Technology

Conti, D. M., and Walkowicz, J. L., Eds., Computer Science and Technology: Computer Performance Evaluation Users Group (CPEUG), Proceedings of the Thirteenth Meeting Held at New Orleans, LA, Oct. 11-14, 1977; Nat. Bur. Stand. (U.S.), Spec. Publ. 500-18, 241 pages (Sept. 1977) Stock No. 003-003-01839-2, $4.

McEwen, H., Coordinator for FIPS Task Group 17C-Data Element Dictionary/Director, Computer Science and Technology: A Survey of Eleven Government-Developed Data Element Dictionary/Directory Systems, Nat. Bur. Stand. (U.S. Spec. Publ. 500-16, 111 pages (Aug. 1977) Stock No 003-003-01817-1, $2.50.

Health and Safety

Durst, R. A., Ed., Blood pH, Gases, and Electrolytes. Proceedings of the Workshop on pH and Blood Gases, held at the National Bureau of Standards, Gaithersburg, MD, July 7-8, 1975, Nat. Bur. Stand. (U.S.), Spec. Publ. 450, 338 pages (June 1977) Stock No. 003-003-01792-2, $4.75.

Engineering, Product and Information Standards

Clark, G., Bit Sequencing of the Code for Information Interchange in Serial-by-Bit Data Transmission, Nat. Bur. Stand. (U.S.), Fed. Info. Process. Stand. Publ. (FIPS PUB) 16-1, 4 pages (1977).

Clark, G., Character Structure and Character Parity Sense for Serial-by-Bit Data Communication in the Code for Information Interchange, Nat. Bur. Stand. (U.S.), Fed. Info. Process. Stand. Publ. (FIPS PUB) 17-1, 4 pages (1977).

Morris, M. C., McMurdie, H. F., Evans, E H., Paretzkin, B., deGroot, J. H., Newberry, R., Standard X-ray Diffraction Powder Patterns. Section 14—Data for 68 Substances, Nat. Bur. Stand. (U.S.), Monogr. 25, Sec. 14, 143 pages (Sept 1977) Stock No. 003-003-01842-2, $2.75

Slattery, W. J., Index of U.S. Nuclear Standards, Nat. Bur. Stand. (U.S.), Spec. Publ. 483, 127 pages (Aug. 1977) Stock No. 003-003-01822-8, $2.75.

Lasers and Their Applications

West, E. D., and Schmidt, L. B., A System for Calibrating Laser Power Meters for the Range 5-100 W, Nat. Bur. Stand. (U.S.), Tech. Note 685, 27 pages (May 1977) Stock No. 003-003-01789-2, 65 cents.

Processing and Performance of Materials

Shives, T. R., and Willard, W. A. Eds., MFPG. Detection, Diagnosis and Prognosis, Proceedings of the 26th Meeting of the Mechanical Failures Prevention Group held at the IIT Research Institute, Chicago, IL, May 17-19, 1977, Nat. Bur. Stand. (U.S.), Spec. Publ. 494, 296 pages (Sept. 1977) Stock No. 003-003-01844-9, $4.50.

Standard Reference Materials

Ditmars, D. A., Cezairliyan, A., Ishihara, S., and Douglas, T. B., Standard Reference Materials: Enthalpy and Heat Capacity Standard Reference Material: Molybdenum SRM 781, from 273 to 2800 K, Nat. Bur. Stand. (U.S.), Spec. Publ. 260-55, 80 pages (Sept. 1977) Stock No. 003-003-01836-8, $2.20.

Other Subjects of General Interest

Burris, B. L., Ed., Publications of the National Bureau of Standards 1976 Catalog. A Compilation of Abstracts and Key Word and Author Indexes, Nat. Bur. Stand. (U.S.), Spec. Publ. 305 Suppl. 8, 728 pages (June 1977) Stock No. 003-003-01743-4, $8.25.

Publications listed here may be purchased at the listed price from the U.S. Government Printing Office, Washington, D.C. 20402 (foreign: add 25%). Microfiche copies are available from the National Technical Information Service, Springfield, VA 22161. For more complete periodic listings of all scientific papers and articles produced by NBS staff, write: Editor, Publications Newsletter, Administration Building, National Bureau of Standards, Washington, D.C. 20234.

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NEWS BRIEFS

NEW ENERGY GUIDE AVAILABLE. NBS, in cooperation with the Department of Energy, has published a new guide designed for managers of small business which use furnaces, kilns, and ovens. The book supplies simple methods to identify energy used by these pieces of equipment, reduce their energy consumption, and estimate possible dollar savings. Energy Management for Furnaces, Kilns, and Ovens, NBS Handbook 124, is available for $1.60 a copy (plus 25 percent for foreign mailing) from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Use SD Stock No. 003-003-01811-2 when ordering.

A PRICE TAG ON CORROSION. Metallic corrosion may cost the United States more than 4 percent of the Gross National Product--about $70 billion--each year according to a new economic study by the National Bureau of Standards. In addition, says the report, corrosion wastes about 3-1/2 percent of the total U.S. energy demand and about 2 percent of the yearly consumption of metallic ores. About $10 billion of the expense could be avoided by making the most economical use of present-day corrosion-control technology, according to NBS.

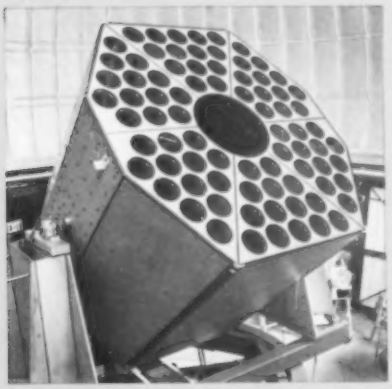
WITH SIRENS BLARING. If you've ever been stopped for speeding and questioned the accuracy of the radar, you're not alone. The NBS Law Enforcement Standards Laboratory has begun a project to test police radar and other speed-measuring equipment for such characteristics as accuracy and susceptibility to interference. Performance standards will be developed as part of the three-year project which is sponsored by the National Highway Traffic Safety Administration.

NBS REORGANIZATION FINAL. A plan for reorganizing the National Bureau of Standards has been approved by the Department of Commerce and is now official. The reorganization, which will be discussed in the June issue of DIMENSIONS/NBS, will be wholly operational as of April 9.

HEAD OF METRIC BOARD NAMED. Dr. Louis Polk has been named by President Carter to head the new U.S. Metric Board. A native of Dayton, Ohio, Polk has had a distinguished career as an industrialist, and is an internationally recognized expert in measurement science. Dr. Polk was a founding director of the American National Metric Council. He is scheduled to outline the role of the new Board in a luncheon address at ANMC's Annual Conference in Atlanta on April 3.

NEXT MONTH IN

DIMENSIONS/NBS



To some people, a new telescope for moon watching resembles the eye of a fly. The device was designed to capture laser light as it completes a roundtrip journey to the moon. Read about lunar ranging and the fly's eye telescope in the next issue of DIMENSIONS/NBS.

U.S. DEPARTMENT OF COMMERCE
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Sidney Harman, Under Secretary

Jordan J. Baruch, Assistant Secretary for Science and Technology

NATIONAL BUREAU OF STANDARDS
Ernest Ambler, Director

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The National Bureau of Standards was established by Congress in 1901 to advance the Nation's science and technology and to promote their effective application for public benefit. Manufacturing, commerce, science, government, and education are principal beneficiaries of NBS work in the fields of scientific research, test method development, and standards writing. DIMENSIONS NBS describes in technical and general terms results of NBS activity in areas of national concern such as energy conservation, fire safety, computer applications, environmental protection, materials utilization, and consumer product safety and performance. The functions of NBS are divided among four major institutes; Institute for Basic Standards, Institute for Materials Research, Institute for Applied Technology, and Institute for Computer Sciences and Technology.

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Annual subscription: Domestic, $12.50, foreign, $15.65, single copy, $1.05. The Secretary of Commerce has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through June 30, 1981.